Kidde Residential and Commercial
1016 Corporate Park Drive
Mebane, NC 27302
Tel 1.919.304.8244 Fax 1.919.563.4304
www.kiddeus.com

June 17, 2015

Mr. Richard Struckmeyer
Licensing Branch
Division of Materials Safety and State Agreements
Office of Federal and State Materials and Environmental Management Programs
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

RE: NRC Licenses No. 32-23858-01E

Richard,

This is to request the following amendments to license No. 32-23858-01E and to have our license authorized pursuant to 10 CFR 32.14 *et seq* rather than Section 32.26 of Title 10 of the Code of Federal Regulations.

Addition of the follow device models to our smoke detector distribution authority:

Device Model	Maximum Quantity Per Device
235 Series	1.00 microcurie (40.7 kBq)
305 Series	0.50 microcurie (20.4 kBq)
311 Series	0.77 microcurie (31.5 kBq)

to our existing:

Device Model	Maximum Quantity Per Device
0905	1.0 microcurie
0906	1.0 microcurie
0908	1.0 microcurie
1225	1.0 microcurie
1255	1.0 microcurie
200 Series	1.0 microcurie

to be distributed from the following facilities:

- 1016 Corporate Park Drive, Mebane, North Carolina
- 1027 Corporate Park Drive, Mebane, North Carolina
- 1394 South Third Street, Mebane, North Carolina
- 3825 S. Willow Avenue, Fresno California
- 101 Veterans Drive, Portland, Tennessee

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Mebane, NC 27302
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Please find enclosed the Form 313, and all the supporting documentation required.

1. Details of chemical and physical form of, and maximum quantity in each product, as required by 10 CFR 32.14(b)(1).

   See type 200 chamber evaluation report

2. Details of construction and design of each product, as required by 10 CFR 32.14(b)(2).

   The foil source used in the type 200 ion chamber is a laminated structure with the radioactive layer over plated with gold. See attached source information The source is riveted into the source holder which is also riveted into the chamber insulator assembly. The same source and source holder are used in all Kidde ionization smoke alarms.

3. The method of containment or binding of the radioactive byproduct material in the product, as required by 10 CFR 32.14(b)(3).

   The alarms that the type 200 chamber is use in are all constructed with plastic housings. The plastics used are chosen to meet the flammability, temperature, stability and impact resistance criteria outlined in the UL standard for that category of smoke alarm (AC or battery powered) The housings consist of a plastic base and cover the size of the alarms range from 4 inches across to 7 inches across. The plastic for all models has a minimum thickness of 0.062 inches thick. All models are agency tested. This testing included 5 drop tests from 7 feet, jarring tests and vibration tests

4. The radiation level and method of measurement for each product for which limits on levels of radiation are specified in 10 CFR 30.15. 10 CFR 30.15(a)(8) states that the levels of radiation from each electron tube containing byproduct material do not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber.

   See Gerald D Rork Report

5. describe the proposed method of labeling or marking each unit and its container with the identification of the manufacturer or initial transferor and the byproduct material in the product, as required by 10 CFR 32.14(b)(6) and 32.15(d)(1).

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www.kiddeus.com

Packaging for all alarms contains the following text which is readable prior to sale of the product.

"This alarm features an ionization sensor designed to detect products of combustion using the ionization technique. It containso.9 microcuries of americium241 a radioactive material. The purchaser is exempt from any regulatory requirements. This product is distributed under U.S. NRC license number 32-23858-011E and is manufactured in compliance with 10 CFR 32.27

each product will contain less than or equal to 1.0 microcuries AM-241

6. the byproduct material is properly contained in the product under the most severe conditions that are likely to be encountered in normal use and handling, as required by 10 CFR 32.14(d), as follows: ……..

See type 200 chamber evaluation report

Kidde would like to amend NRC License to:

1. Reflect the licensee address as:
   1016 Corporate Park Drive, Mebane, North Carolina

2. We will continue to use the following Distribution facilities as:
   - 1016 Corporate Park Drive, Mebane, North Carolina
   - 1027 Corporate Park Drive, Mebane, North Carolina
   - 1394 South Third Street, Mebane, North Carolina
   - 3825 S. Willow Avenue, Fresno California

Sincerely,

Patrick Keough, RSO
Logistics Manager

NRC FORM 313 (03-2014)
10 CFR 30, 32, 33, 34
35, 36, 37, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIALS LICENSE

APPROVED BY OMB: NO. 3150-0120 **EXPIRES: 05/31/2015**

Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the FOIA, Privacy, and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW. *AMENDMENTS/RENEWALS THAT INCREASE THE SCOPE OF THE EXISTING LICENSE TO A NEW OR HIGHER FEE CATEGORY WILL REQUIRE A FEE.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

OFFICE OF FEDERAL & STATE MATERIALS AND
ENVIRONMENTAL MANAGEMENT PROGRAMS
DIVISION OF MATERIALS SAFETY AND STATE AGREEMENTS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA,

SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PA 19406-2713

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING,

SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
1600 E. LAMAR BOULEVARD
ARLINGTON, TX 76011-4511

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [x] B. AMENDMENT TO LICENSE NUMBER 32-23858-01E
- [ ] C. RENEWAL OF LICENSE NUMBER

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*

1016 Corporate Park Drive
Mebane, NC 273021

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

1016 Corporate Park Drive
Mebane, NC 27302

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Patrick Keough, RSO

BUSINESS TELEPHONE NUMBER	BUSINESS CELLULAR TELEPHONE NUMBER
(919) 304-8244	(919) 614-3540

BUSINESS EMAIL ADDRESS

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
   a. Element and mass number; b. chemical and/or physical form; and c. maiximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES (Fees required only for new applications, with few exceptions*) *(See 10 CFR 170 and Section 170.31)* FEE CATEGORY _____ AMOUNT ENCLOSED $ _____

13. CERTIFICATION. *(Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.*

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35 , 36, 37, 39, AND 40, AND THAT ALL INFORMATION CONTANED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.
WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A C RIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
Patrick Keough, Logistics Manager		06-17-15

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED $	CHECK NUMBER	COMMENTS
APPROVED BY				DATE	

APPENDIX D

EVALUATION OF
SAFETY CRITERIA per 32.27 10 CFR

PREPARED FOR:

Fyrnetics, Inc.
Type 200 Ionization Chamber

Prepared by:
Gerald D. Rork
Smoke Detector Consultant
P.O. Box 142
Dundee, Illinois 60118
(708) 428-4409

Risk Analysis Page 1

Exposure, Dose and Dose Commitment

Note: Measured exposure rates are shown in Appendix 1.

1. Normal handling and use of a single unit

A. Transport by consumer.

Assumptions:
1. 1.0 uCi Am 241 per detector.
2. Transport time - 0.5 hours
3. Distance - 1 meter.
4. Exposure rate is the maximum measured for these model detectors - 0.83 uR/hr at 25 cm or 5.19E-3 uR/hr at 1 meter.
5. 0.93 rem/R.

Whole body dose = 5.19E-9 R/hr X 0.5 hr X 0.93 rem/R
= 2.4E-9 rem.

B. Installation by consumer.

Assumptions:
1. 1.0 uCi Am 241 per detector.
2. Installation time by consumer - 0.25 hr.
3. Average distance = 0.5 meter.
4. Exposure rate is the maximum measured for these model detectors - 0.83 uR/hr at 25 cm or 2.1E-8 uR/hr at 0.5 meter.
5. 0.93 rem/R.

Whole body dose = 2.1E-8 uR/hr X 0.5 hr X 0.93 rem/R
= 9.77E-9 rem.

C. Detector in home.

Assumptions:
1. 1.0 uCi Am 241 per detector.
2. Occupancy factor in bedroom is 8 hr per day.
3. Average distance = 3 meter.
4. Exposure rate is the maximum measured for these model detectors - 0.83 uR/hr at 25 cm or 6.9E-9 uR/hr at 3 meter.
5. 0.93 rem/R.

Whole body dose = 6.9E-9 R/hr X (8 X 365 hr/year)
X 0.93 rem/R.
= 1.87E-5 rems.

D. Disposal of a single unit.

The consequences of disposal of smoke detectors in normal household trash is discussed in Reference 1. This discussion is not repeated here.

These doses or dose commitments do not exceed those specified in Column 1 of the table in 32.28 10 CFR.

Exposure, Dose and Dose Commitment (cont.)

2. Normal handling and storage of quantities of detectors.

A. Warehouse worker

Assumptions:
1. 1.0 uCi Am 241 per detector.
2. 40 hour work week, 2000 hours per year.
3. 4 hours per week with hands in contact with a detector in a box and 36 hours per week at 25 cm from a detector.
4. Box provides shielding equivalent to 5 cm of distance.
5. 40 hours per week at 3 meters from a stacked array of 1000 detectors.
6. Exposure rate is the maximum measured for these detectors - 0.741 uR/hr at 5 cm and 0.083 uR/hr at 25 cm.
7. 0.93 rem per R.

Single Detector

Dose to hands = 7.41E-7 R/h X 4 hr/wk X 50 wk/yr
X 0.93 rem/R
= 1.38E-4 rem/yr.

Whole Body Dose = 8.3E-8 R/hr X 36 hr/wk X 50 wk/yr
X 0.93 rem/R
= 1.39E-4 rem/yr.

Stacked Array (Reference 2)

Whole Body Dose = 0.25 uR/hr X 2000 hr/yr X 0.93 rem/R /3
= 1.55E-4 rem/yr.

Total Whole Body Dose = 1.39E-4 rem + 1.55E-4 rem
= 2.94E-4 rem/yr.

These doses or dose commitments do not exceed those specified in Column 1 of the table in 32.28 10 CFR.

Exposure, Dose and Dose Commitment

3. Reduction in containment or shielding from normal wear and abuse.

A. Normal wear.

The outer surfaces of the ionization chamber consist of the sense chamber and the printed wiring board. The sense chamber is made out of 0.3 mm stainless steel. There are no known wear-out mechanisms of this material. The printed wiring board is made out of 1.6 mm epoxy impregnated fiberglass. There are no known wear-out mechanisms of this material. The ionization chamber is further protected by the plastic cover and base which are snapped together.

Thus, it is unlikely that there will be a reduction in the containment or shielding of the ionization chamber due to wear during normal handling of the product.

B. Abuse.

Since there are no wear out mechanisms of the materials used in the ionization chamber, a reduction in the containment or shielding could only occur due to intentional tampering or from the effects of a fire.

1. External Exposure - Intentional Tampering.

Assumptions: 1. 1.0 uCi source removed from detector and placed at 1 cm air equivalent from body for 24 hours.
2. Specific gamma constant for Am 241 is 1.2E-8 R/hr at 1 m/uCi.
3. 0.93 rem/R.

Dose = 1.2E-8 R/hr X $(100 \text{ cm/m})^2$ X 24 hr X 0.93 rem/R
= 2.68E-3 rem.

Note: In order for the source assembly to be placed next to the body the detector and the ionization chamber would have to be disassembled. This is unlikely but possible.

Exposure, Dose and Dose Commitment

B. Abuse (cont.)

2. Ingestion of a Single Source Assembly

Assumptions:
1. 1.0 uCi per Source Assembly.
2. 50 year dose commitment.
3. 1.0% of foil content removed while in GI tract (Reference 4).
4. 1.5% of Am 241 lost from foil absorbed by blood (Reference 4).
5. Fifty (50) year dose conversion factors for ingestion (Reference 1).

Whole Body = 5.42E - 2 (rem/uCI)
Liver = 2.85E - 1 (rem/uCi)
Skeleton = 8.21E - 1 (rem/uCi)
Kidneys = 4.07E - 1 (rem/uCi)

Dose Commitment = 1uCi X 0.01 X 0.015 X Dose Conversion Factor

= 8.13E - 6 rem Whole Body
= 4.28E - 5 rem Liver
= 1.23E - 4 rem Skeleton
= 6.11E - 5 rem Lungs

Note: In order for the source assembly to be ingested the detector and ionization chamber would have to be disassembled. This is unlikely but possible.

Even under these abnormal conditions, these doses or dose commitments do not exceed those specified in Column 1 of the table in 32.28 10 CFR.

Exposure, Dose and Dose Commitment

3. Dose and Dose Commitment from Fire in a Warehouse Containing Storred Detectors.

Note: The worst case condition that could occur would be due to a fire in Fyrnetics' warehouse since this building would contain the largest number of units likely to accumulate in aany one place.

1. Inhabitants of Building

Assumptions: 1. Fifty (50) year dose conversion factors for inhalation (Reference 1).

Whole Body = 2.4E+1 (rem/uCi)
Liver = 3.2E+2 (rem/uCi)
Skeleton = 3.3E+2 (rem/uCi)
Lungs = 5.2E+1 (rem/uCi)

2. Ten percent (10%) of the 0.5 Ci present (500,000 units) is incinerated.
3. 0.1% of the Am 241 incinerated is converted to airborne particulates (Reference 3).
4. Total air mixing with no air exchange from outside building.
5. Inhabitants remain in the building for two minutes after Am 241 is incinerated.
6. Breathing rate = 14 liters per 2 minutes.
7. Volume of building = 3.06E+6 liters.

Dose Commitment = 1E-1 X 0.5E+6 uCi X 1E-3 X 14 1 X Dose Conversion Factor/3.06E+6 1
= 2.28E-4 uCi X Dose Conversion Factor

= 5.49E-3 rem Whole Body
= 7.32E-2 rem Liver
= 7.54E-2 rem Skeleton
= 1.18E-2 rem Lungs

Even under these abnormal conditions, these doses or dose commitments do not exceed those specified in Column 2 of the table in 32.28 10 CFR. Thus, it may be concluded that the probability is low that the containment could fail in a manner such that these doses or dose commitments would be exceeded.

Exposure, Dose and Dose Commitment

2. Fireman Fighting Fire From Downwind

Assumptions:
1. Dose Conversion Factors as above.
2. One hundred percent (100%) of the 0.5 Ci present is incinerated during a one hour fire.
3. 0.1% of the Am 241 incinerated is converted to airborne particulates. (Reference 3)
4. Breathing rate = 420 l/hr.
5. Building integrity is breached.
6. Venting causes a ten-fold reduction in concentration.
7. Volume of building = 3.06E+6 liters.
8. One hour is spent in fighting the fire from downwind.

Note: Due to the chemical toxicity of the smoke, it is impossible that a fireman could spend one hour breathing the smoke without breathing apparatus. A reasonable estimate of the reduction in dose commitment due to use of breathing apparatus is at least a factor of ten.

It is also unlikely that all of the Am 241 would be incinerated since this assumes that the sprinkler system does not work and the fire fighting efforts are totally unsuccessful in putting out the fire in less than one hour. Thus, this calculation represents only an extremely unlikely worst case scenario.

Dose Commitment = 5E+5 uCi X 1E-3 X 420 l X 1E-1 X 1E-1
X Dose Conversion Factors/3.06E+6 l

= 6.86E-4 X Dose Conversion Factors

Dose Commitment = 0.0165 rem Whole Body
= 0.220 rem Liver
= 0.226 rem Skeleton
= 0.0357 rem Lungs

Even under these abnormal conditions, these doses or dose commitments do not exceed those specified in Column 2 of the table in 32.28 10 CFR. Thus, it may be concluded that the probability is negligible that the containment could fail in a manner such that these doses or dose commitments would exceeded those specified in Column 3 of the table.

REFERENCES (Copies available upon request)

1."Environmental Assessment of Ionization Chamber Smoke Detectors Containing Am 241", NUREG/CR-1156.

2. This calculation uses the same assumptions shown in 3.2.4.2 of Reference 1, except for the 1/3 factor to account for the 1 uCi per detector.

3. Reference 1 uses this same assumption. It is consistent with the data shown in : Niemeyer, R.G., "Containment Integrity of Ra 226 and Am 241 Foils Employed in Smoke Detectors" ORNL-TM-2684.

4. Rundo, J.,et al. "Ingestion of Am Sources Intended for Domestic Smoke Detectors: Report of a Case". Health Physics Volume 33, Pages 561-566, (1977).

Gerald D. Rork
ıoke Detector Consultant

P.O. BOX 142
DUNDEE, ILLINOIS 60118
(708) 428-4409

July 18, 1991

Ms. Joanne Sha
Radiation Protection Officer
Fyrnetics, Inc.
1021 Davis Road
Elgin, IL 60123

Dear Ms. Sha

At your request, I have evaluated the design of the type 200 ionization chamber that you propose to use in future Fyrnetics smoke detectors. This evaluation only considered the radiological safety aspects of the design. Enclosed is a report of my evaluation.

In my professional opinion, the Type 200 ionization chamber, when installed in a smoke detector, meets all criteria set forth in 32.26and 32.27 Chapter 10 Code of Federal Regulations.

Please contact me if there are any questions or if additional formation is necessary.

Best regards,

Gerald D. Rork
Smoke Detector Consultant

Evaluation of Ionization Chamber Design

Fyrnetics, Inc. Type 200

Performed for:

FYRNETICS, INC.
1021 Davis Road
Elgin, Illinois 60120

Performed by:

Gerald D. Rork
Smoke Detector Consultant
P.O. Box 142
Dundee, IL 60118
(708) 428-4409

rnetics, Inc. Type 200 Ionization Chamber

1. General Description

The Type 200 ionization chamber is a totally new design from those previously licensed by the U.S.N.R.C. See the enclosed assembly drawing (Drawing 0910-9501) for construction details.

As in previous designs, the radioactive material, Americium 241, maximum quantity 1 uCi, is encased in noble metal foil. The type of foil containing the radioactive material in the Type 200 ionization chamber is identical to that used in presently licensed ionization chambers. The foil meets the requirements for a sealed source as defined in ISO Standard 1677.

The complete foil is manufactured by either of two fully licensed vendors:

NRD, Incorporated
2937 Alt Boulevard
Grand Island, NY 14072

Amersham Corporation
2637 Clearbrook Drive
Arlington Heights, IL 60005

Details of the method of foil construction and licenses of these vendors are on file with the U.S. Nuclear Regulatory Commission.

The foil (Drawing 0905-4109), in the form of a 2.4 mm diameter disk, is retained in a stainless steel source holder (Drawing 0910-4103) by swaging three areas of the source holder. These swaged areas are 120 degrees apart and retain the foil in the source holder. Details of the swaging and the quality assurance procedures to be followed to insure retention of the foil in the source holder are enclosed as Appendix 1 to this report.

A portion of the source holder passes through the plastic chamber housing (Drawing 0910-2106) and source plate (Drawing 0910-4102). The source holder is fastened to the source plate by three swaged areas of the source holder. This assembly clasps the plastic chamber housing between the source holder and the source plate and the swaged areas secure all the parts together.

The plastic chamber housing serves as an insulator which holds the reference plate (Drawing 0910-4101) in the correct position. The reference plate is fastened to the insulator by three pegs deformed by heat staking.

eneral Description (cont.)

The source holder, source plate, reference plate and plastic chamber housing form the reference chamber. The assembled reference chamber is secured to the printed wiring board by three barbed legs that are inserted into slots in the board. The assembly is further secured by a leg of the source plate that is soldered to the printed wiring board. In addition, a leg of the reference plate is soldered to the integrated circuit which further secures the assembly in place.

The reference plate, together with the sense chamber (Drawing 0910-4106) form the smoke sensing chamber. This sense chamber has two tabs which pass through slots in the printed wiring board and are soldered to the board.

The printed wiring board, with attached ionization chamber and associated electronic components, is attached to the detector base by snap over barbs molded into the plastic base.

The plastic detector cover is fastened to the base by three molded barbs which snap into three molded retainers in the base.

2. Radiological Safety Features

Radioactive Material Containment

The type of foil containing the radioactive material in the Type 200 ionization chamber is identical to that used in ionization chambers presently licensed for distribution by Fyrnetics.

The foil is retained in a stainless steel source holder by three swaged portions of the holder. This method of foil retention is being used in detectors presently distributed under license by other manufacturers with excellent results.

Appendix 2 to this report contains the results of vibration and drop testing of samples of smoke detectors containing the type 200 ionization chambers. After the testing, only insignificant levels of removable contamination were found. There was no reduction in integrity of any of the ionization chambers and all foils were retained in the source holder following the tests.

The quality assurance procedures to be followed to insure retention of the radioactive foil in the source holder are enclosed as Appendix 1 to this report. In addition, if a foil were to come loose from the source holder after the ionization chamber were assembled and installed in a smoke detector, the detector would not operate properly. This would be discovered during the 100% functional checking performed during the production process.

B. Access to Radioactive Material

Direct access to the radioactive material contained in a Type 200 ionization chamber is not normally possible. Such access would only be possible by intentional disassembly of the smoke detector containing the ionization chamber and the chamber itself. Such disassembly would first require removal of the plastic cover from the base. This removal would require the use of tools to release the barbed fittings which hold the cover to the base or a severe impact.

After removal of the cover, only the external surfaces of the ionization chamber are accessible. These are formed by the sense chamber and the printed wiring board. The sense chamber is formed from 0.3mm thick stainless steel. The printed wiring board is made of 1.6 mm thick epoxy impregnated fiberglass. Both of these materials are very strong and durable and the probability is negligible that they could degrade sufficiently to provide access to the radioactive material.

There are no openings in the printed wiring board which could provide access to the radioactive material. The sense chamber is slotted to allow smoke entry. The slots are formed by punching in a portion of the chamber to form louvered openings. These openings are such that no line-of-sight path to the foil containing the radioactive material exists. The slots are only 0.8 mm wide by 10 mm long and thus entry into the chamber is impossible for any part of the human body.

Access to the radioactive material would require removal of the sense chamber. This would require either un-soldering of the two tabs which hold the chamber to the printed wiring board or cutting of the chamber or board. This does not constitute normal use or wear of a smoke detector.

Based on the above discussion, it may be concluded that it is unlikely that there will be a significant reduction in the effectiveness of the containment or other safety features of the detectors during normal wear or abuse.

C. Radioactive Material Shielding

Appendix 3 to this report shows the results of measurements of the exposure at 5 and 25 centimeters from four samples of this type chamber assembled into smoke detectors. As will be noted, the maximum exposures measured were: 0.741 uR/hr at 5 cm and 0.083 uR/hr at 25 cm. Based on these exposures, it can be concluded that any dose or dose commitment will not exceed the criteria set forth in 32.27 10 CFR.

Exposure to the Public

Use of the type 200 ionization chamber in smoke detectors, rather than the types of chambers presently licensed, will not change the quantity of radioactive material in each detector. Also, it will not change the number of smoke detectors distributed to the public. Consequently, there will be on change in the already low risk of exposure to the public.

4. Conclusions

Based on the foregoing, it may be concluded that use of the Type 200 ionization chamber in smoke detectors will not result is any significant radiation exposure to the public. In my professional opinion, the type 200 ionization chamber meets the criteria for licensing as set forth in 32.26 and 32.27 10 CFR.

Gerald D. Rork
Smoke Detector Consultant